

SECTION 33: WATER MAIN INSTALLATION

33-01 SCOPE. The Work shall consist of furnishing and installing water mains, valves, fittings, fire hydrants, thrust blocks and appurtenances; and testing and chlorinating the same in accordance with the Plans and these Standard Provisions, with the end result being a completed project ready for use.

33-02 MATERIALS.

33-02.01 Ductile Iron Water Pipe. Ductile iron water pipe shall be Class 52 conforming to AWWA Standards C150 and C151 with cement lining conforming to AWWA Standard C104. Ductile iron pipe ends shall be push-on or mechanical joint conforming to AWWA Standard C111 or with ends joined by a method approved by the Engineer which employs a single circular rubber gasket. Rubber gaskets and rings shall be neoprene synthetic rubber ASTM Type CR. All ductile iron pipes and fittings shall be wrapped in an 8-mil. thick polyethylene film sleeve.

33-02.02 Polyvinylchloride Pipe. Polyvinylchloride pipe shall conform to the requirements of the latest revision of the "AWWA Standard for Polyvinylchloride (PVC) Pressure Pipe, 4" through 12" for Water" (ANSI/AWWA C900). Polyvinylchloride (PVC) pipe shall conform to the requirements of "Class 200" pipe of the above specification except where otherwise noted. Certificates of requirements will be required from the manufacturers of the pipe to be used. Rubber rings and gaskets shall be as required by the manufacturer.

33-02.03 Fittings, Ductile Iron Pipe. Fittings for ductile iron pipe shall be cement-lined in accordance with AWWA Standards C104, C110 or C153. Mechanical joint or push-on joint ends may be substituted for the bell ends. Flange ends, except as required by the Plans or the Standard Details, may be substituted only after approval of the Engineer.

33-02.04 Fittings, Polyvinylchloride Pipe. Fittings for polyvinylchloride pipe shall be cement-lined in accordance with AWWA Standards C104, C110 or C153. Mechanical joint or push-on joint ends may be substituted for the bell ends. Flange ends, except as required by the Plans or the Standard Details, may be substituted only after approval of the Engineer. The joints shall also conform in all respects to the latest revision of AWWA C111.

33-02.05 Gate Valves. Gate valves shall be epoxy-coated Mueller RSGV A-2370 resilient seat gate valves with stainless steel bolts, "O" ring seals, nonrising stem, open left, two-inch (2") brass square wrench nut and with 304 stainless steel retainer nut inside, in accordance with AWWA C509, or an approved equal. The valves shall have ends designed to joint directly with the type of pipe being used or with ends called for on the Plans. 304 Stainless steel bolts and nuts shall be

used for flanged joints, and cord 10 bolts and nuts shall be used for mechanical joints. Tapping valves shall be Mueller RSGV H-687, or an approved equal.

33-02.06 Gate Valve Boxes. Gate valve boxes shall be Christy Concrete Products, Inc., Type G-5 traffic valve box with C-275 lid or an approved equal. Covers shall be marked "Water." Gate valve risers shall be a single length of eight-inch (8") cast iron pipe, or eight-inch (8") polyvinylchloride pipe Class 150.

33-02.07 Blowoff and Air Relief Boxes. Valve boxes for manual blowoffs and air relief assemblies shall be Christy Concrete Products, Inc. Type G-12 traffic valve box with G-12C lid, or approved equal. Covers shall be marked, "Water."

33-02.08 Fire Hydrants. Fire hydrants shall be fusion epoxy-lined Mueller Model A481, Clow Company No. 76 or Long Beach Logan No. 651 with two 2-1/2" N.S.T. hose outlets, one 4-1/2" N.S.T. hose outlet, one 1/8" pentagonal tips on caps and valve stems, or an approved equal. Hydrant bury shall be 30" to 48" long with 6" inlet.

33-02.09 Hydrant Riser. Hydrant risers or extension shall be Rich Valve Company or Logan with localized breakoff scoring on the exterior near each flanged end, or an approved equal. Break-off bolts shall be hollow.

33-02.10 Mechanical Joint. The mechanical joint bell, flange, bolts, follower gland sealing gasket and accessories shall conform to the requirements of AWWA Standard C-111. Bolts shall be of high-strength low-alloy steel in accordance with AWWA C-111.

33-02.11 Flanges. Steel pipe flanges shall conform to the requirements of AWWA Standard C207, Class D.

Bolts shall be of high-strength low-alloy steel in accordance with AWWA C-111. Flange and bolt coatings shall match adjacent pipe.

33-02.12 Insulating Flanged Joints. Each insulating flange set shall consist of a full-face central gasket, a full-length sleeve for each flange bolt, and two (2) insulating washers with two (2) steel washers for each bolt. The ring type central gasket shall be one-eighth inch (1/8") thick sheet packing, having a high dielectric constant. Bolt sleeves shall be fabric reinforced phenolic resin and insulating washers shall be constructed of fabric reinforced phenolic resin. The complete assembly shall have an ANSI pressure rating equal to that of the flanges between which it is installed.

33-02.13 Casings for Water Mains. Steel casings utilized used for boring and jacking for water mains shall conform with the Standard Specifications Section 70, Paragraph 70-1.02B. All metallic water mains installed in casing shall be electrically

isolated from the casing by means of casing insulators. The casing shall be coated and lined with coal tar enamel in accordance with AWWA C203.

33-02.14 Casing Insulators. Insulators utilized for electrical isolation shall be twelve inches (12") wide, two-piece steel band type. Each insulator shall have an insulating liner with a thick retainer type edge to isolate the steel bands from the carrier pipe. Insulating runners shall be one inch (1") wide steel capped with molded rubber or polyester fiberglass. Insulator spacing shall be determined by the Contractor according to manufacturer's recommendations for each pipeline alternate and approved by the Engineer. The outside diameter of the casing insulator skids shall be sufficient height to isolate all portions of the carrier pipe from the casing.

33-02.15 Casing End Seals. After installation of the carrier pipe, the ends of the casing shall be sealed. End seals shall be pull-on type, S-shaped, constructed of one-eighth inch (1/8") minimum highly flexible synthetic rubber. Each end seal shall be furnished with two 1/2", 14-gauge stainless steel bands for banding the seal to the casing and carrier pipe.

33-02.16 Epoxy Coatings. Epoxy coatings for fittings shall be 12-mil. minimum thickness Scotchkote 206N fusion bonded epoxy coating manufactured by 3M, or equal. The application of the coating and preparation of the substrate shall be in accordance with the manufacturer's recommendations.

All valves, flexible coupling adapters and flexible couplings shall be fusion epoxy coated to not less than 12 mils and shall be subjected to thickness and discontinuity (holiday) testing at the discretion of the City Engineer.

33-02.17 Portland Cement Concrete. Portland cement concrete for hydrant bases, thrust blocks and anchors shall conform to the requirements of Section 90, "Portland Cement Concrete," of the Standard Specifications and specified herein. The concrete shall be Class "B" containing five (5) sacks of Portland cement per cubic yard of concrete. The grading of the combined aggregate shall conform to the requirements of one and one-half inches (1-1/2") maximum. The addition of calcium chloride for high early strength concrete shall not be permitted.

The consistency of the fresh concrete shall be such that the slump does not exceed four inches (4") as determined by Test Method No. California 520. The concrete shall have a minimum compressive strength of 2,500 PSI after twenty-eight (28) days.

33-02.18 Chlorine. Hypochlorite shall conform to AWWA Standard B300. Liquid chlorine shall conform to the AWWA Standard B301.

33-02.19 Bitumastic. Bitumastic for coated couplings, rods, fittings and joints shall conform to the requirements of Bureau of Reclamation Specification CA-50.

33-02.20 Tracer Wire. Unless otherwise specified on the Plans, tracer wire shall be bare six-gauge copper wire.

33-03 CONSTRUCTION METHODS. The Contractor shall give forty-eight (48) hours' notice to the City's Public Services Division when making connections to existing water facilities. At all times, the manipulation of existing valves shall be done by Water Division personnel.

33-03.01 Handling of Materials. Water pipe, fittings, hydrants and valves must be carefully handled at all times. Only suitable and proper equipment and appliances shall be used for the safe loading, hauling, unloading, handling and placing of materials. Special care shall be exercised so that the coating on pipe, valves and fittings will not be damaged. If such damage should occur, the coating shall be repaired to the satisfaction of the Engineer. Chain slings will not be permitted. Pipe loaded on trucks or stacked one upon another shall be supported on wooden blocking. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground.

33-03.02 Trenching. Trench excavation, shoring, backfill and resurfacing shall conform to the requirements of Section 24, "Trench Excavation, Backfill and Resurfacing," of these Standard Provisions.

33-03.03 Pipe Laying. All pipe shall be laid to conform to AWWA Standards C600 and C603. All pipe shall be laid true to line and grade as shown on the Plans or as directed by the Engineer to pass existing obstructions. Before any length of pipe is laid, it shall be carefully inspected for defects. No pipe or other material which is cracked or shows other defects shall be installed.

When the pipe joints are to be caulked, initial backfilling (by hand tamping between the pipe joints) shall be completed before caulking.

All pipe, valves and fittings must be carefully wiped out and cleaned as they are installed. Any earth or rubbish which may have lodged inside during or before laying shall be removed. Every open end of installed pipe shall be capped or plugged with an approved fitting at all times when work is suspended, at the close of the workday and as directed by the Engineer.

Pipe must be given a solid, uniform bearing in the bottom of the trench. Blocking or supporting pipe on earth mounds will not be permitted. Whenever it is necessary to use a short length of pipe at a fitting or valve, the minimum length shall be thirty-two inches (32"). If it is necessary to cut pipe, said cut shall be made with an approved pipe cutter. The use of hammer and chisel for pipe cutting will not be permitted.

A six-gauge solid copper wire shall be installed in the trench with C-900 polyvinylchloride pipe and spliced to any existing tracer wire. The wire shall be taped to the top center of the pipe. The wire shall be installed in such a manner that there is no direct contact between the copper and any other metal in the trench.

33-03.04 Joints. All joints shall be assembled to conform to AWWA Standards C600 and C603. All joints shall be watertight and shall be made by competent workmen. Unless otherwise specified on the Plans or in these Standard Provisions, joints may be of any of the types listed below which are consistent with the type of pipe being used, except that joints shall in no case be caulked with cement. Bond all rubber gasket joints of ductile iron or steel pipes and fittings.

33-03.05 Work Involving Asbestos-Cement Pipe. Field cutting and machining operations involving asbestos-cement pipe shall be in compliance with OSHA Asbestos Construction Activities, CCR Title 8, Construction Safety Orders (CSO), Section 1529.

Power-driven saws and abrasive discs shall not be used for the dry cutting or beveling of asbestos-cement pipe unless they are equipped with local exhaust ventilation and a high efficiency particulate air (HEPA) filter dust collection system.

Pressure or "wet" tapping of asbestos-cement pipe shall be positive purge, blowoff or other type that allows pipe cuttings to be flushed from the pipe.

33-03.06 Mechanical Joints. The last eight inches (8") of the outside of the spigot and inside of the bell of mechanical joints shall be thoroughly cleaned of all oil, grit and other foreign material by brushing with a wire brush and then painted with a soap solution made by dissolving one-half (1/2) cup of granular soap in one (1) gallon of water. The cast iron gland shall be placed on the pipe with the lip extension of the gland towards the socket or bell end of the joint, and the rubber gaskets shall be painted with a soap solution and placed on the pipe with the thick edge towards the gland. The pipe shall be pushed into the bell to seat the spigot and the gasket pressed into place within the bell, being careful to have the gasket evenly located around the entire joint. The cast iron gland shall be placed against the gasket, the bolts inserted and the nuts tightened with a suitable (preferably torque-limiting) wrench. The range of torque for three-quarters inch (3/4") bolts shall be seventy-five (75) to ninety (90) foot-pounds. Nuts spaced one hundred eighty degrees (180°) apart shall be tightened alternately in order to produce an equal pressure on all parts of the gasket. Bond all mechanical joints.

33-03.07 Push-On Joints for Ductile Iron Pipe. The joints shall be of a type which employs a single elongated rubber gasket to effect the joint seal. The

assembly of the joint shall be made as recommended by the manufacturer. Bond all push-on joints.

33-03.08 Setting Valves, Fittings and Hydrants. Gate valves shall be set with stems in vertical position and provided with valve boxes. Gate valves shall be anchored as shown on the Plans or the Standard Details.

Fire hydrants and fire hydrant connections shall be installed where indicated on the Plans, except where the Engineer directs that they shall be relocated to avoid an obstruction. The Contractor shall make such relocations at the time of reconstruction and without additional compensation. Each hydrant shall be installed in accordance with the Standard Detail for hydrants or as shown on the Plans.

33-03.09 Connection to Existing Mains. The Contractor shall make connections to existing mains where indicated on the Plans. The newly installed facilities are to be kept isolated from the City system until bacteriologically acceptable. If isolation is provided by a closed gate valve, pressure testing for leakage in the new facilities shall only be conducted after bacteriological acceptance.

The Engineer shall designate method and sequence of connecting to existing mains to minimize contamination danger. Connections to existing valves prior to obtaining satisfactory leakage and pressure tests of the new facilities shall be at the Contractor's risk.

The City will assume no responsibility for the watertightness of existing valves.

Service in existing mains can be interrupted only upon authorization of the Engineer, who will specify time and duration of the outage. The Contractor shall notify all affected users in writing at least forty-eight (48) hours in advance of service interruption using printed forms provided by the Engineer. The Contractor shall request the Engineer to notify the City Public Services Division personnel at least forty-eight (48) hours in advance to schedule valve closing for service interruption. Manipulation of new or existing valves shall only be done by Water Division personnel.

33-03.10 Air Reliefs and Blowoffs. Air relief and blowoff assemblies shall be located as shown on the Plans and installed in accordance with the Standard Details.

33-03.11 Painting. All metals anodic to ductile iron that are not adequately protected against corrosion by a suitable protective coating shall be carefully cleaned and given a thick coating of a good quality mastic coating solution paint. This paint shall be allowed to harden before the material is covered with polyethylene wrap and backfill material.

All valves, flexible coupling adapters and flexible couplings shall be fusion epoxy coated to not less than 12 mils and shall be subjected to thickness and discontinuity (holiday) testing at the discretion of the City Engineer.

Bolts, nuts, washers and any other metallic elements exposed to the soil shall be coated with bitumastic in accordance with Section 33-02.19, "Bitumastic," of these Standard Provisions.

Fire hydrants shall be painted bright silver with rust preventive paint such as "Aervoe," "Krylon," "Rustoleum" or an approved equal.

33-03.12 Joint Bonding. All nonwelded rubber gasket joints, mechanical joints and fusion epoxy coated flanges shall be bonded in accordance with Standard Details or as shown on the drawings. Joint bonds shall be installed with a cable loop extended above the field joint mortar or joint coating for pretensioned concrete cylinder pipe and mortar lined and coated steel pipe. The overall length of the conductor shall permit maximum movement of the pipe joint without transferring any tensile stress to the cable. Cable to rod connections shall be accomplished as specified below. All exposed surfaces of the steel rod shall be completely encased in joint mortar as shown on the drawings.

33-03.13 Insulating Flanged Joints. All insulating components of the insulating flanged gasket set shall be cleaned of all dirt, grease, oil and other foreign materials immediately prior to assembly. Bolt holes in mating flanges shall be properly aligned at the time bolts and insulating sleeves are inserted to prevent damage to the insulation. After flanged bolts have been tightened, each insulating washer shall be inspected for cracks or other damage. All damaged washers shall be replaced. After assembly, resistance between each bolt and flange shall be measured with an approved ohmmeter, and the minimum resistance shall be 50,000 ohms. Where the insulating joint is assembled in the shop and shipped as a unit, resistance shall be measured in the shop between the flanges and between each bolt and flange and shall meet the above requirements. All insulating flanged joints shall be coated as shown on the Standard Details and specified herein.

33-03.14 Leakage Tests. Each run of pipe between two (2) sectionalizing valves or between a valve and a cap or plug shall be tested for leakage. Only one (1) run of pipe shall be tested at a time, but the pressure may be applied through sections of pipe already tested. Services and fire hydrant runs may be tested individually or with the sections of water main. It is the intention of these tests to test the watertightness of the closed gate valves as well as the piping. When the newly constructed facilities are connected to existing water mains, bacteriological clearance shall be obtained before conducting pressure or leakage tests.

The Contractor shall furnish all equipment for making tests, including a suitable gauge for measuring the applied line pressure. The tank containing the water to maintain line pressure shall be of a design such that the volume of water may be accurately measured.

The hydrostatic test pressure shall be one hundred fifty (150) pounds per square inch, based on the elevation of the lowest point of the section under test and corrected to the elevation of the test gauge.

The test pressure shall be maintained for one (1) hour by pumping water from the measuring tank into the line. At the end of the hour, the volume of water pumped into the line will be measured and recorded as the leakage.

No pipe installation will be accepted until the leakage in each section is less than the following:

a. Ductile Iron Pipe. The allowable leakage rate shall be as defined in AWWA Standard C600, Section 4.

b. Steel Pipe with Welded Field Joints. No leakage allowed. Testing procedures shall conform to AWWA Standard C206, Section 6.

c. Polyvinylchloride Pipe. The allowable leakage rate shall be as defined in ANSI/AWWA C900-81, AWWA Manual M23.

33-03.15 Disinfecting. All lines, mains and branches shall be disinfected by chlorination in accordance with AWWA Standards C651 and B301, "Disinfecting Water Mains," and specified herein. Chlorine may be a one percent (1%) solution (containing ten thousand (10,000) parts per million available chlorine) or may be obtained by the use of dry chlorine in tablet form firmly attached to interior walls of the pipe.

The weight of chlorine or chlorine compound required to make one percent (1%) chlorine solution is as follows:

<u>Product</u>	<u>Amount of Compound</u>	<u>Quantity of Water (Gallons)</u>
High-Test Calcium Hypochlorite (65%-70% Cl)	1 Lb.	7.50
Chlorinated Lime (32%-35% Cl)	2 Lbs.	7.50
Liquid Laundry Bleach (5.25% Cl)	1 Gal.	4.25
Liquid Chlorine (100% Available Chlorine)	0.62 Lbs.	7.50

The required concentration of chlorine in the pipe is fifty (50) parts per million. This concentration may be attained by adding five (5) gallons of the chlorine solution to one thousand (1,000) gallons of water.

The required concentration of chlorine in the mains may be obtained by the use of HTH tablets as produced by Olin Mathieson in the following quantities:

HTH TABLET (70% DOSAGE)

Number of Tablets Per Length of Pipe

<u>LENGTH OF SECTION</u>	<u>DIAMETER OF PIPE</u>				
	<u>4"</u>	<u>6"</u>	<u>8"</u>	<u>10"</u>	<u>12"</u>
13'	1	2	2	3	5
18'	1	2	3	5	6
20'	1	2	3	5	7
30'	2	3	5	7	10
36'	2	3	5	8	12
40'	2	4	6	9	14
100'	4	9	15	23	30

a. Liquid Chlorine Solution Method. Flush all foreign matter from mains, branch runs, hydrant runs and installed services. Introduce liquid chlorine solution at appropriate locations to assure uniform distribution through the facilities at

the proper concentration. Installed copper service lines shall not be used to convey the concentrated solution to the mains. The sanitizing solution shall be retained in the facilities for a period of twenty-four (24) hours, after which each service, hydrant run, branch run and dead end shall be flushed until the residual chlorine is less than one (1) part per million or is no greater than the concentration of chlorine in the water supplied for flushing.

b. HTH Tablet Method. Tablets are to be fastened to the inside top surface of each length of pipe using "Permatex No. 2" at time of pipe laying. Tablets shall not be available at any time for casual pilferage by the general public or by children. The new facilities are to be slowly filled with water. Air is to be exhausted from each dead end, branch run, hydrant run and installed service. Retain water for a period of twenty-four (24) hours, after which each service, hydrant run, branch run and dead end shall be thoroughly flushed to clear foreign matter and until the residual chlorine concentration is less than one (1) part per million or is no greater than the concentration of chlorine in the water supplied for flushing.

c. Bacteriological Testing. Samples shall be gathered and tests conducted at the expense of the Contractor by a laboratory approved by the Engineer. Samples are to be taken at representative points at the direction of the Engineer as follows:

1. The first sample shall be taken twelve (12) hours after the line is flushed.
2. The second sample shall be taken twenty-four (24) hours later.

The tested line shall be required to be coliform negative for at least two (2) consecutive days. If any sample is positive, that location shall be resampled.

The new facilities shall remain isolated and out of service until satisfactory test results have been obtained which meet the requirement of the California Department of Public Health and the Engineer has accepted the results as indicative of the bacteriological condition of the facilities. If unsatisfactory or doubtful results are obtained from the initial sampling, the chlorination process shall be repeated until acceptable test results are reported.

33-03.16 Abandoning Existing Water Mains. The existing water main pipeline to be abandoned shall be cut a minimum of 12" clear from the main pipeline to be left in service. Nonmetallic water main pipelines to be abandoned shall be filled with sand. All water main pipelines to be abandoned shall be plugged at the ends with a minimum of six inches (6") of Portland cement concrete at each required cut.

33-04 MEASUREMENT.

33-04.01 Water Mains. Water mains shall be measured horizontally by the linear foot through valves and fittings. Pipe for fire hydrant runs shall not be measured as water main.

33-04.02 Gate Valves. Gate valves shall each be measured as one complete installed unit in operable condition, including gate valve, anchor block, valve box and valve box riser.

33-04.03 Fire Hydrants. Fire hydrants shall each be measured as one complete installed unit in operable condition, including hydrant, gate valve (if specified), breakoff riser, breakoff check valve (if specified), bury, thrust block and piping from main to bury.

33-04.04 Air Relief, Blowoff Assemblies. Air relief and blowoff assemblies shall each be measured as one complete installed unit in operable condition, including valve, valve box, curb stop, copper tubing, corporation stop, service clamp and any other necessary fittings.

33-04.05 Fittings for Water Mains. Fittings for water mains shall be included as part of the water main installation payment.

33-04.06 Trench Surfacing. The surfacing over mains, fire hydrant runs and stubouts shall not be measured for payment.

33-04.07 Anchors and Thrust Blocks. Anchors and thrust blocks shall not be measured for payment.

33-04.08 Abandoning Existing Water Mains. Existing water main pipelines to be abandoned shall be measured as one complete unit, including concrete for both ends.

33-05 PAYMENT.

33-05.01 Water Main. The Contract price per linear foot for water mains shall constitute full compensation for all labor, materials and tests necessary to furnish and install the pipe, including fittings, thrust blocks and anchorage, trenching, polyethylene sleeve, bond joints, backfill and surfacing as required in the Special Provisions, shown on the Plans and specified herein.

33-05.02 Gate Valves. The Contract price per each gate valve shall constitute full compensation for all Work and materials, including gate valve, anchor

block, valve box and valve box riser necessary to complete installation of gate valves, as required in the Special Provisions, shown on the Plans and specified herein.

33-05.03 Fire Hydrants. The Contract price per each for fire hydrants shall constitute full compensation for all Work and materials, including hydrants, gate valves (if specified), breakoff riser, breakoff check valve (if required), bury thrust block, polyethylene sleeve, bond joints and piping from the water main gate valve to bury necessary to complete installation of fire hydrants as required in the Special Provisions, shown on the Plans and specified herein.

33-05.04 Air Relief, Blowoff Assemblies. The Contract price per each air relief and blowoff assemblies shall constitute full compensation for all Work and materials, including valve box, curb stop, copper tubing, corporation stop, service clamp and any other fittings necessary to complete installation of the air relief and blowoff assemblies as required in the Special Provisions, shown on the Plans and specified herein.

33-05.05 Abandoning Existing Water Mains. The Contract unit price for each water main pipeline that is abandoned shall constitute full compensation for all Work and materials required to complete the abandonment of the water main as required in the Special Provisions, shown on the Plans and specified herein.